

What is claimed is:

1. A ferrofluid pivot bearing comprising:

a shaft;

a first magnetic element fixedly attached to said shaft forming a shaft

5 assembly;

a housing containing said first magnetic element fixedly attached to said shaft

wherein said housing is rotatable about said first magnetic element; and

a quantity of magnetic fluid between said housing and said first magnetic  
element.

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2. The pivot bearing of Claim 1 wherein said shaft is non-magnetic.

3. The pivot bearing of Claim 1 wherein said housing is non-magnetic.

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4. The pivot bearing of Claim 1 further comprising a magnetic coating over a least  
a portion of an outside surface of said housing.

5. The pivot bearing of Claim 4 wherein said a magnetic coating covers  
substantially all of the major surfaces of said outside surface of said housing.

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6. The pivot bearing of Claim 1 wherein said magnetic coating contains one or  
more of nickel, iron, and nickel-iron alloy.

7. The pivot bearing of Claim 1 further comprising at least a second magnetic element fixedly attached to said shaft.

5 8. The pivot bearing of Claim 7 further comprising an inner bearing element fixedly attached to said shaft between said first magnetic element and said at least a second magnetic element.

10 9. The pivot bearing of Claim 8 wherein said inner bearing element is made of a magnetic material.

10. The pivot bearing of Claim 1 further comprising an outer bearing element adjacent said first magnetic element and an end of said housing.

15 11. The pivot bearing of Claim 10 wherein said outer bearing element is made of a magnetic material.

12. The pivot bearing of Claim 1 further comprising a ferrofluid-repellent coating on a portion of said shaft corresponding to the ends of said housing.

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13. The pivot bearing of Claim 1 further comprising a ferrofluid-repellent coating on a portion of said housing located at the ends of said housing adjacent to said shaft.

5 14. A ferrofluid pivot bearing comprising:

a shaft;

a first magnetic element concentrically and fixedly attached to said shaft;

a housing having a first end and a second end, said first end and said second

end having a central opening sized to receive said shaft, said housing

10 containing said first magnetic element fixedly attached to said shaft

wherein said housing is rotatable about said first magnetic element; and

a quantity of magnetic fluid within said housing.

15 15. The pivot bearing of Claim 14 wherein said shaft is non-magnetic.

16. The pivot bearing of Claim 14 wherein said housing is non-magnetic.

17. The pivot bearing of Claim 14 further comprising a magnetic coating over at least a portion of an outside surface of said housing.

20 18. The pivot bearing of Claim 17 wherein said magnetic coating covers substantially all of the major surfaces of said outside surface of said housing.

**19.** The pivot bearing of Claim 14 wherein said magnetic coating contains one or more of nickel, iron, and nickel-iron alloy.

5 **20.** The pivot bearing of Claim 14 further comprising at least a second magnetic element fixedly attached to said shaft.

10 **21.** The pivot bearing of Claim 20 further comprising an inner bearing element fixedly attached to said shaft between said first magnetic element and said at least a second magnetic element.

**22.** The pivot bearing of Claim 21 wherein said inner bearing element is made of a magnetic material.

15 **23.** The pivot bearing of Claim 14 further comprising an outer bearing element adjacent said first magnetic element and said first end of said housing.

**24.** The pivot bearing of Claim 23 wherein said outer bearing element is made of a magnetic material.

**25.** The pivot bearing of Claim 14 further comprising a ferrofluid-repellent coating on a portion of said shaft corresponding to said first end and said second end of said housing.

5 **26.** The pivot bearing of Claim 14 further comprising a ferrofluid-repellent coating on a portion of said housing located at said first end and said second end of said housing and adjacent to said shaft.

**27.** A method of making a ferrofluid pivot bearing comprising:

10 obtaining a non-magnetic shaft;

fixedly attaching a first magnetic element to said non-magnetic shaft wherein said magnetic element is concentric with said shaft;

forming a housing for containing said first magnetic element wherein said housing is rotatable about said first magnetic element;

15 placing said first magnetic element and said shaft within said housing such that said first magnetic element is enclosed within said housing; and

adding a quantity of magnetic fluid to said housing sufficient to form a ferrofluid magnetic seal between said first magnetic element and the inside surface of said housing.

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**28.** The method of Claim 27 further comprising coating a ferrofluid repellent material onto an area of said shaft adjacent to the ends of said housing.

**29.** The method of Claim 27 further comprising coating a ferrofluid repellent material onto an area of said housing ends opposed to the circumference of said shaft.

5 **30.** The method of Claim 27 further comprising disposing a conductive layer over the outside circumferential surface of said housing.

10 **31.** The method of Claim 30 wherein said disposing step includes disposing said conductive layer over substantially all of the major outside surfaces of said pivot bearing.

15 **32.** The method of Claim 27 further comprising fixedly attaching at least a second magnetic element to said shaft, said at least a second magnetic element positioned to be enclosed within said housing.

**33.** The method of Claim 32 further comprising fixedly attaching an inner bearing element to said shaft between said first magnetic element and said at least a second magnetic element.

20 **34.** The method of Claim 27 further comprising fixedly attaching an outer bearing element to said shaft adjacent to said first magnetic element and an end of said housing.

35. The method of Claim 27 wherein said housing forming step includes sizing the inside diameter of said housing for receiving said first magnetic element to provide a gap between the inside surface of said housing and the outside diameter of said first magnetic element sufficient for using the magnetic flux field created by said first magnetic element to support rotational movement of said housing relative to said first magnetic element.

36. The method of Claim 27 wherein said housing forming step includes sizing the inside diameter of said housing for receiving said first magnetic element to provide a gap between the inside surface of said housing the outside diameter of said first magnetic element sufficient to form said ferrofluid magnetic seal when said magnetic fluid is added to said housing.

37. A method of making a ferrofluid pivot bearing, said method comprising:  
using the magnetic flux field of at least a first magnetic element concentrically mounted to a shaft and contained within a housing having a quantity of magnetic fluid therein, said magnetic flux field and said magnetic fluid supporting rotational movement between said housing and said shaft.

**38.** The method of Claim 37 further comprising attaching a bearing element to said shaft adjacent to said at least a first magnetic element, said bearing element being made of a magnetic material.

5    **39.** The method of Claim 37 further comprising attaching at least a second magnetic element to said shaft such that said at least a second magnetic element is contained within said housing, said at least a second magnetic element being used to support rotational movement of said shaft.

10   **40.** The method of Claim 39 further comprising adding an inner bearing element between said at least a first magnetic element and said at least a second magnetic element, said inner bearing element being made of a magnetic material.

15   **41.** The method of Claim 37 further comprising disposing a magnetic material over the outside circumferential surface of said housing.

**42.** The method of Claim 37 further comprising disposing a magnetic material over all of the major outside surfaces of said housing.



43. A method of using the magnetic flux field of a magnet as the support mechanism for a pivot bearing, said method comprising:

forming a housing for receiving a shaft assembly;

forming said shaft assembly wherein said shaft assembly has a shaft and at

5 least one magnetic element fixedly attached to said shaft;

inserting said shaft assembly into said housing; and

adding a quantity of magnetic fluid to said housing.